

The silica and the lime, Mr. Gregor considers as essential to the composition of this mineral, as he has always discovered them, even in the purest specimens.

In order to examine the nature of the volatilized matter, the author submitted some of the crystals to distillation. A fluid passed over into the receiver, and a white crust was formed in the arch and neck of the retort. The fluid had an empyreumatic smell, very similar to that observed in the fluid distilled from the white crust that surrounds flint. It changed litmus paper to a faint reddish hue. A variety of experiments were made upon the white crust, from the results of which it appeared, that it consisted in part, at least, of an acid, which did not seem to be either the phosphoric or fluoric; nor did its properties entirely agree with those of the oxalic acid, although many of them were similar to those of that acid. A part of the fore-mentioned crust, which firmly adhered to the neck of the retort, was found to contain a portion of lead; this, Mr. Gregor ascribes to the action of the acid on the retort.

Some of the Barnstaple mineral was also tried, and was found likewise to produce the above-mentioned white crust. Mr. Gregor now makes some remarks on the yellow and green crystals already mentioned as accompanying the mineral here treated of, which he says he at first considered as similar to the two species of Uran-glimmer examined by Klaproth. The specific gravity of the yellow crystals, at 45° Fahr., was 2.19. Exposed to the blowpipe, they decrepitated violently. They are taken up by phosphate of ammonia and soda without effervescence, and communicate a light emerald green colour to the fused globule. By exposure to a red heat they become of a brassy colour, and lose nearly a third part of their weight.

Several other experiments upon them are related, but their scarcity has, Mr. Gregor says, precluded him from operating on a quantity sufficient for a regular analysis. But he has detected in them oxide of lead, lime, and silica, which have not hitherto been considered as ingredients of Uran-glimmer.

The substance also, which in his experiments was held in solution by ammonia, had some peculiar properties which appeared to distinguish it from uranium.

The green crystals, the author says, do not differ from the yellow, except in containing a little of the oxide of copper.

The Croonian Lecture on the Arrangement and mechanical Action of the Muscles of Fishes. By Anthony Carlisle, Esq. F.R.S. F.L.S.
Read November 7, 1805. [*Phil. Trans.* 1806, p. 1.]

The muscles of fishes, Mr. Carlisle says, are constructed very differently from those of the other natural classes of animals. The medium in which fishes reside, the form of their bodies, and the instruments employed for their progressive motion, give them a character peculiarly distinct from the rest of the animal creation. Their skeleton is simple, and their proportion of muscular flesh is remark-

ably large; but the muscles have no tendinous chords, their insertions being always fleshy. There are, however, semi-transparent pearly tendons placed between the plates of muscles, which give origin to a series of short muscular fibres, passing nearly at right angles between the surfaces of the adjoining plates.

The progressive motion of fishes, our author says, is chiefly performed by the flexions of the trunk and tail; the pairs of fins, which some have considered as analogous to feet, being only employed for the purposes of turning, stopping, altering the position of the fish towards the horizon, and keeping the back upwards. The single fins appear to prevent the rolling of the body whilst the tail is employed to impel it forwards. Each of the fins, which are in pairs, is capable of four motions, viz. of flexion and extension, like oars, and of expanding the rays, and closing them.

Mr. Carlisle now (taking the Cod as a standard of comparison,) describes particularly the mode in which the various motions here spoken of are performed, and then relates some experiments made to determine the effect of the fins on the motions of fishes. For this purpose a number of dace, equal in size, were put into a large vessel of water, and the pectoral fins of one of them being cut off, it was replaced with the others. The result was, that the progressive motion of the fish was not at all impeded; but its head inclined downwards; and when it attempted to ascend, the effort was attended with difficulty.

From another fish, both the pectoral and abdominal fins were taken. The fish remained at the bottom of the vessel, and could not be made to ascend. Its progressive motion was not perceptibly more slow; but when the tail acted, the body showed a tendency to roll, and the single fins were widely expanded, as if to counteract this effect.

From a third fish the single fins were removed. This produced an evident tendency to turn round, and the pectoral fins were kept constantly extended, to obviate that motion.

From a fourth fish all the fins were removed. Its back was kept in a vertical position, whilst at rest, by the expansion of the tail; but it rolled half round at every attempt to move.

From a fifth fish the tail was cut off as close to the body as possible. The progressive motion of the fish was considerably impeded, and the flexions of the spine were much increased; but neither the pectoral nor the abdominal fins seemed to be more actively employed.

From a sixth fish all the fins and the tail were removed. It remained without motion, floating near the surface of the water, with its belly upward.

The above experiments were repeated on the roach, the gudgeon, and the minnow, with similar results.

Mr. Carlisle now observes, that the muscles of fishes differ very materially in their structure from those of other animals; that they are apparently more homogeneous; that their fibres are not so much fasciculated, but run more parallel to each other, and are always

comparatively shorter; and that they become corrugated at the temperature of 156° of Fahrenheit, when their tendinous and ligamentous attachments are dissolved, and their serous juices coagulated. He then proceeds to give a very minute description of the situation and arrangement of the various series which form what are called the lateral muscles of the body. The nerves belonging to these muscles are also described; and mention is made of loose transparent vesicles about the size of a millet-seed, containing a white substance like carbonate of lime, which vesicles are found within the sheath of the nerves, at the point of their junctions.

The rate at which fishes move through so dense a medium as water, is, our author says, very remarkable; and although this may be partly accounted for by the large proportion of muscles, and their advantageous application, yet the power would be inadequate to the effect if it were not suddenly exerted: this appears from the slow progress of eels, and such other fishes as, from their length and flexibility, are incapable of giving a sudden lateral stroke.

But the quickness and force of action in the muscles of fishes is counterpoised by the short duration of their power. Those accustomed to the diversion of angling, know how soon the strength of fishes is exhausted; for if the hooked fish is kept in constant action, it soon loses the ability to preserve its balance, and turns upon its side. This, Mr. Carlisle says, has been vulgarly attributed to drowning, in consequence of the mouth being closed upon the hook; but the same effects, he says, take place when the hook is fastened to the side or the tail; and he thinks that this prostration of strength may depend partly on fear, and partly on interrupted respiration; since fishes, when swimming rapidly, keep the *membrana branchiostegæ* closed, and when nearly exhausted, act violently with their gills.

The shortness of the muscular fibres, and the multiplied ramifications of the blood-vessels, are probably peculiar adaptations for the purpose of gaining velocity of action, which seems invariably connected with a very limited duration of it. Such examples, our author thinks, form an obvious contrast with the muscular structure of slow-moving animals, and with those partial arrangements where unusual continuance of action is concomitant.

Since Mr. Carlisle's former communications respecting the arteries of slow-moving muscles, another instance has been pointed out to him by Mr. Macartney, in the muscles of the feet and toes of birds, which seems to be an adaptation for the alternate rest of their limbs while sleeping.

The muscles of the human body which perform the most rapid actions, have their fibres subdivided by transverse tendons, or are arranged in a penniform direction. The *semi-tendinosus* and *semi-membranosus* of the thigh are thus constructed, and the *recti abdominis* are divided into short masses by transverse tendons. All these muscles cooperate in the action of leaping.

These observations, the author thinks, tend to explain that diversity

which is found in the lengths of various muscles that act together; as by that means organs of velocity are joined with those of power.

The Bakerian Lecture on the Force of Percussion. By William Hyde Wollaston, *M.D. Sec. R.S.* Read November 14, 1805. [*Phil. Trans.* 1806, p. 13.]

The force of percussion is a subject, respecting the estimation of which a controversy has subsisted for more than a century past between different classes of philosophers. For although it is agreed that when unequal bodies move with the same velocity, the forces are as their quantities of matter; yet when equal bodies move with unequal velocities, there are two methods of estimating the comparative forces of such bodies. Leibnitz and his followers conceive the forces to vary as the squares of the velocities; while their opponents maintain that the forces are in the simple ratio of the velocities of the bodies respectively. The latter have been considered as Newtonians; but Dr. Wollaston endeavours to show that they can derive no support from any expressions of Newton.

In order to explain the grounds for each opinion, the author proposes the following experiment.

He supposes a ball of clay to be suspended at rest, having two similar and equal pegs slightly inserted into its opposite sides; and he supposes two other bodies, A and B, which are to each other in the proportion of 2 to 1, to strike at the same instant against the opposite pegs, with velocities which are in the proportion of 1 to 2. In this case, the ball of clay would not be moved from its place to either side; nevertheless, the peg impelled by the smaller body B, which has the double velocity, would be found to have penetrated twice as far into the clay as the peg impelled by the larger body A.

It is, Dr. Wollaston says, unnecessary to make the above experiment precisely as it is here stated, because the results are admitted as facts by both parties; but upon these facts they reason differently. One party, observing that the ball of clay remains unmoved, considers the proof indisputable, that the action of the body A is equal to that of the body B, as they would be led to expect, because their *momenta* are equal. Their opponents think it equally proved, by the unequal depths to which the pegs have penetrated, that the causes of these effects are unequal, as they would have expected, from considering the forces as proportional to the squares of the velocities.

The former party observe, in this experiment, that equal *momenta* can resist equal pressures during the same *time*; the other party attend to the *spaces* through which the same moving force is exerted, and finding them to be in the proportion of 2 to 1, observe that the *vis viva* of a body in motion is justly estimated by the magnitude and the square of the velocity jointly,—a multiple to which Dr. Wollaston has thought it convenient to give the name of Impetus.

This latter conception, of a quantity of force as a *vis motrix* extended through space, rather than continued for a certain time, is an